MMT Observatory

Smithsonian Institution & The University of Arizona®

End of Quarter Summary

July - September 2014

MMT Observatory • The University of Arizona • Tucson, Arizona 85721 • PHONE: 520. 621. 1558 • FAX: 520. 621.4144

MMT Observatory Activities

Our Quarterly Summary Reports are organized using the same work breakdown structure (WBS) as used in the annual Program Plan. This WBS includes a major category with several subcategories listed under it. In general, many specific activities might fall a tier or two below that. The WBS will be modified as needed in future reports.

Administrative

Scheduling

Summer shutdown started on July 15 and ended on August 18. An all-hands cleaning day of the observatory took place on the final day of shutdown, and the observatory reopened on August 19.

Reports and Publications

There were 27 peer-reviewed MMT-related publications and three non MMT-related publications during this reporting period. No technical memoranda or reports were generated. See the listing of publication in Appendix I, p. 22.

Presentations and Conferences

G. Williams, D. Blanco, and J. Hinz attended a conference held August 18-20 in Flagstaff, Arizona to discuss saving dark skies. The title of the conference was "Blinded by the Light: A Summit and Call to Action to Protect our Night Skies." The conference brought together city planners, state and national park services, highway planners, lighting contractors, and the astronomy community with the goal of developing safe, sensible lighting ordinances that minimize city glow and preserve our night skies.

T. Gerl and C. Knop attended the National Safety Council (NSC) Congress and Expo held September 14-19 in San Diego. They attended courses covering various facets of safety including:

- Be Your Brother's Keeper: Watching Out for Others
- Deep Safe: The Future of Safety
- The Psychology of Safety: Paradigm Shifts for Achieving an Injury-Free Culture
- Transforming Your Safety Culture Through Culture Assessment
- Safety 24/7 at Work, Home and Play: The Tony Crow Story
- Your Mother Doesn’t Work Here: Housekeeping and Safety
- No Chemical Left Behind: Your GHS/HazCom Compliance Roadmap

They also attended several keynote presentations and collected contact information of new vendors.

Safety

Training

Several MMTO mountain staff participated in fire alarm training held October 14 at the F.L. Whipple Administrative Complex.

Procedures and Protocols

New procedures were started for fire shutdown, lightning shutdown, power outage, and emergency front shutter closure. A binder was created and placed near the telescope operators' station, storing these procedures in one location.

Personal Protective Equipment

While attending the NSC Expo, T. Gerl and C. Knop spoke with various vendors regarding new protective products including safety glasses, safety shoes, online SDS databases, and improved razor blade designs, and brought new razor blade samples back for staff to use.

Interlock System

The 26V interlock rack was reworked during summer shutdown to improve the reliability of the safety system. Old wiring, temporary jumpers and patches/splices, and obsolete equipment were removed. A new DIN rail was added in anticipation of the installation of new equipment. Drawings and other documentation for the system were updated to reflect the rework.

Primary Mirror

A new hand-held dust monitor was purchased. It will be useful in determining when it is safe to open for observing or when dust levels warrant closure to protect the mirror and its coating.

The primary mirror was washed on July 17, resulting in greatly improved scattering and reflectance measurements.

Figure 1. The primary mirror wash took place on July 17.

The plots below show the reflectance and scattering measurements before and after the wash. For comparison, results from the 2010 coating are also shown.

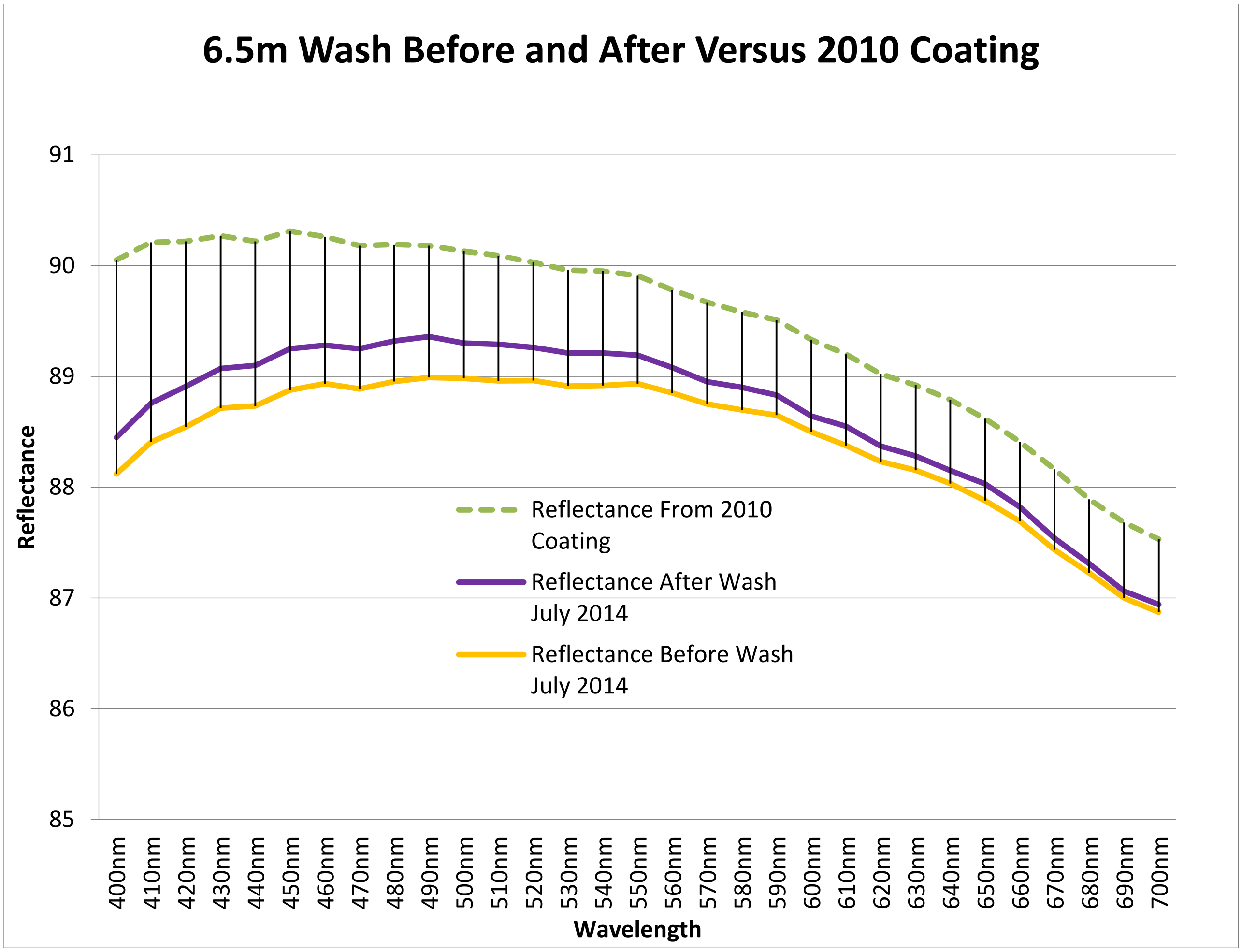

Figure 2. Wash reflectance comparison.

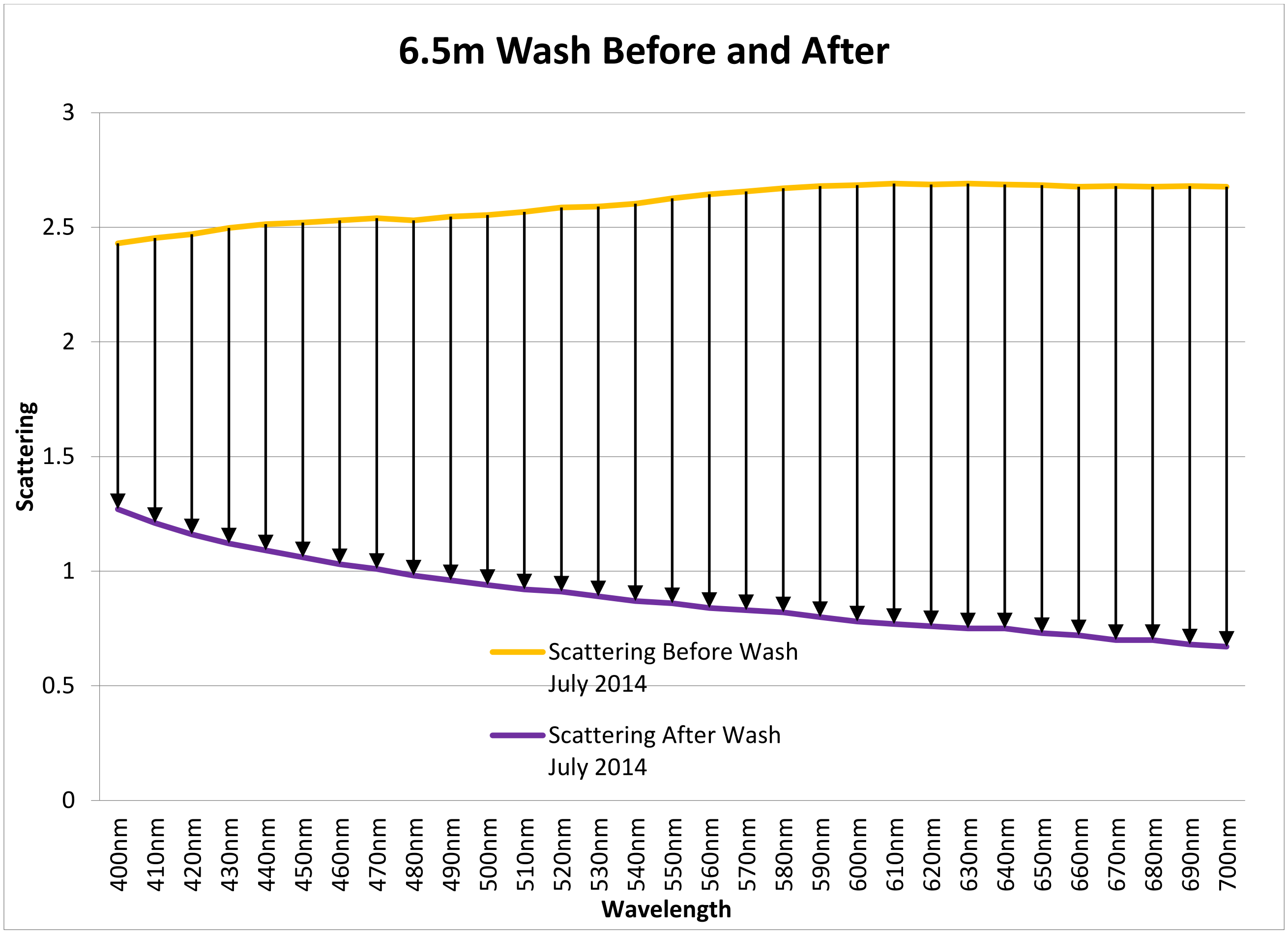

Figure 3. Wash scattering comparison.

Coating & Aluminization

The internal revision of the response to the Aluminization Readiness Review Committee was completed and circulated to the Committee on August 7.

After some additional testing of the aluminum core filaments with less overall length than the 23H filament currently in use, a filament with an overall length of 25 inches was selected for fabrication and further testing using both coating chambers at the Steward Observatory Sunnyside coating facility. Working with MidWest Tungsten Service, 150 filaments were ordered and have been designated 13H (13 wraps in the coil section). Once the Sunnyside facility was available for MMTO use again, the 13H filaments were tested in the small chamber. While this testing showed the process parameters will have to be tweaked in order to take full advantage of the 13H filament (primarily the faster response due to the lower thermal mass), 0.39 grams of aluminum could consistently be evaporated from the filaments when driven with sufficient power. Based on a mass analysis after the successful 2001 coating, the MMTO bell jar requires 0.2 grams of aluminum for an average coating thickness of 1000 angstroms.

With numerous small chamber tests completed, a large chamber test using the new 13H filament was attempted on September 19. However, after the chamber had been pumped down to a sufficient vacuum, both welders would not respond to control commands after being initialized. The issue was not immediately obvious from the initial troubleshooting, and the large chamber vacuum system was shut down. Troubleshooting and further system testing the following week determined the cause of the unresponsive welders was due to the internal welder current limit being tripped by the large inrush. The inrush current was much more substantial than in previous testing due to a change in the welder control boxes that would allow the open circuit voltage to float up the welder maximum of 44 volts. In previous testing, the open-circuit voltage was held at 2.8 volts. The high open circuit voltage was not an issue with the small chamber due to a system resistance at startup that is roughly 2.5 times greater than the large chamber. The welder control boxes have been modified to again limit the open circuit voltage to 2.8 volts. Three large-chamber tests are planned for the first two weeks of October, and these tests should provide enough data to select a filament for use in the MMTO bell jar.

The rework of the M1 (primary mirror) aluminization rough vacuum system progressed to a stage appropriate for system testing. Vacuum gauges were installed and the system was tested in various configurations. Both Kinney mechanical pumps reached a blank off-pressure of roughly 20 milliTorr, which is within the specified pressure range of 10-100 milliTorr. The improvements to the suction line plumbing seem to have improved the oil control, but the pumps will need to be operated for a longer duration to confirm this. The Heraeus roots blower was operated, and a blank off-pressure of 1 milliTorr was reached. Leak testing discovered a minor leak in the blower outlet flange; the leak has been repaired but the system has not been checked for integrity after the outlet flange was reinstalled. Further testing of the rough vacuum system should take place toward the end of October.

Work on the automatic-deposition control software and hardware was suspended during the annual summer shutdown period, but the data from the tests done beforehand were analyzed in detail by W. Goble, and several changes are planned for testing after shutdown:

- There is an apparent ground loop in the welders, the welder control boxes, and the control computer mostly because, unlike the summit, all the equipment is powered from the same source at the Sunnyside facility (the truck-mounted generator), which can lead to some weird effects.
- There is a poorly-understood "dance" that happens after both welders are enabled, particularly with a low-resistance load that may be related to the ground loop and aging electronics.
- We found that the welder control boards themselves required independent testing due to some reliability issues with the boards and their wiring. To this end, a test fixture was designed and constructed just after shutdown to check out the welder board functionality without requiring the entire welder and load setup.
- The welder boards also needed a circuit change to eliminate the load-control circuit's integrator, since it would wind up before the welders were enabled and contribute to a much larger than expected inrush current when driving a low-resistance load. Inrush currents in excess of 990 Å cause a protection circuit to trip inside the welders and require a power cycle on the welder to reset, so the integrators were disabled.

The new welder board tester was assembled, but during initial function testing it was found to have a circuit layout error that required some rework. This, in addition to the many issues with the overall reliability of the welder boxes, motivate a re-spin of the welder control box electronics to cure the long-standing layout errors, clean up the power supplies on the boards, and eliminate the ground loops and interaction between the parts of the system. That re-spin will be prototyped and tested with the small chamber at Sunnyside before going to full production for the system.

Ventilation and Thermal Systems

To provide input for the forthcoming HVAC upgrade, the extensive database of thermal data was mined to estimate the current thermal performance of the outside M1 ventilation equipment. Regardless of the season, the M1 air coming in to the shop heat exchanger is between 25° and 20° C above the outside ambient temperature. Continuing downstream, the air leaving the shop heat exchanger is between 10° and 5° C above ambient, and the air temperature is lowered another 2° to 3° C in the ductwork between the shop heat exchanger and the pit heat exchanger. Additional instrumentation is planned for installation in the glycol plumbing to the shop heat exchanger for further cooling system characterization.

Mount Servos

During summer shutdown, the ELMO test amplifier chassis was extensively bench-tested on the mountain using the spare rotator motor. Several modifications were necessary to make it completely functional, and it now appears that the amplifier is entirely adequate for driving the rotator-axis motors.

More testing with the amplifier on the elevation axis will help determine whether to purchase enough ELMO units to construct new drive amplifier chassis to replace both the rotator and elevation axis drive units that use the now-defunct Copley Controls amplifiers. Once the new chassis are in place and testing proves successful, the Copley units will be relegated to spares; this will make it possible to replace a failed drive unit by swapping out the entire amplifier box, which can be handled easily by the operators alone, if necessary.

Secondary Mirrors

f/15

Work on the new deformable mirror (DM) power supply continues. New cards were ordered for the power supply chassis internal controls, and full-load testing on the VCCL (6.8V) supply was performed with a dummy load providing a 40A continuous load on the supply outputs. Thermal rise was modest, and the supply worked well throughout. The VCCA and VSSA supplies (±15V) will be assembled next for testing. New AWG 1/0 (one aught) contacts will also be ordered for assembling the output conductors with the proper bushings for good low-resistance connections.

Baffling

The air valve handle for the mid baffle was relocated to the south end of the OSS so that it can be operated from the chamber floor after opening the mirror cover.

Hexapods

Nothing to report.

Optics Support Structure (OSS)

Nothing to report.

Pointing and Tracking

Nothing to report.

Science Instruments

f/9 Instrumentation

The Blue and Red Channel Spectrograph websites were updated to include the measured count rate for each instrument for a flat spectrum (in F-nu) object and the antiquated throughput data from the 4.5m MMT were removed. We are in the process of creating new throughput plots for each commonly used grating as a secondary method to show the data.

Work continues on a working prototype exposure-time calculator for both spectrographs. A working prototype is expected to be completed during the October-December quarter.

The f/9 instruments were on the MMT for 40% of the available nights from July 1 through September 30 (not including summer shutdown from July 15 – August 18). Approximately 61% of those nights were scheduled with the Blue Channel Spectrograph, 30% with Red Channel, and 9% with SPOL. Half a night was scheduled for maintenance and engineering (M&E). Of the 191.5 total hours allocated for f/9 observations, 170 hours (89%) were lost to monsoon weather conditions. Instrument, facility, and telescope problems accounted for less than 0.5% of lost time. Blue Channel lost 96% of its time to poor weather, with Red Channel losing 84%, and SPOL losing 50%.

f/5 Instrumentation

The SW dome calibration lamp box required maintenance. The battery in the clock/memory chip within the WebDaq had failed.

This quarter had fewer on-sky hours than usual due to the summer shutdown and a very rainy monsoon.

There were 296 hours scheduled for observation with 178 hours, approximately 60%, lost. Most of the lost hours (172) were lost to weather. A couple of hours were also lost to a problem with telescope oscillation at certain elevations.

There was a positioner failure on the first night of the hecto run in early September, but poor weather made much of the scheduled hecto time missed over the next week difficult to assign as lost to instrument or lost to weather. The few clear hours of time were switched to maintenance and engineering (M&E) or MMTCam observations.

The positioner problem, which showed up as a following error, was a failure of the T1 axis to move. Visual inspection verified that the actuator was barely moving during the home process, which prevented the completion of the home routine. This precluded attempts to position fibers. Preliminary tests revealed nothing wrong with the cable, and the actuator motor resistance indicated that it was properly connected. The servo amplifier for that axis was swapped out, with no change in behavior. At that point, a service mission from Cambridge was set up. When the crew arrived, the problem was still present, and additional cables were checked but no issues were found. The output of the A/D in the VME crate was examined at the amplifier connector, and seemed to respond normally to both open and closed loop commands. We later discovered that the issue with the T1 axis was "fixed," or at least no longer present. Additional tests were done and some cleaning of the electronic's rack was performed to remove accumulated dust on the circuit board and moths in the crate fans. After cleaning the focal plane and reassembling the top and bottom sections of the positioner, we performed further testing and verified that everything was working properly. The instrument was mounted on the telescope at the end of the service mission testing. No further problems with the positioner occurred during the run.

Hecto was on the telescope for eighteen nights this quarter, and data were obtained on ten of those nights. Ninety-nine science exposures were obtained on thirty-two fields. Over 370 calibration exposures were obtained to support these science data.

MMTCam was the exclusive instrument for four nights, and additional data were gathered on five additional nights. A total of 1,346 exposures were taken on forty fields along with 429 calibration exposures.

A new filter was added to MMTCam in place of the z-band filter. This filter is a [S II] 672.4/7.5nm (Sulfur) with a 50mm diameter made by Custom Scientific, and purchased by K. Johnson at the University of Virginia. It was installed by M. Alegria on August 26. The filter profile is below.

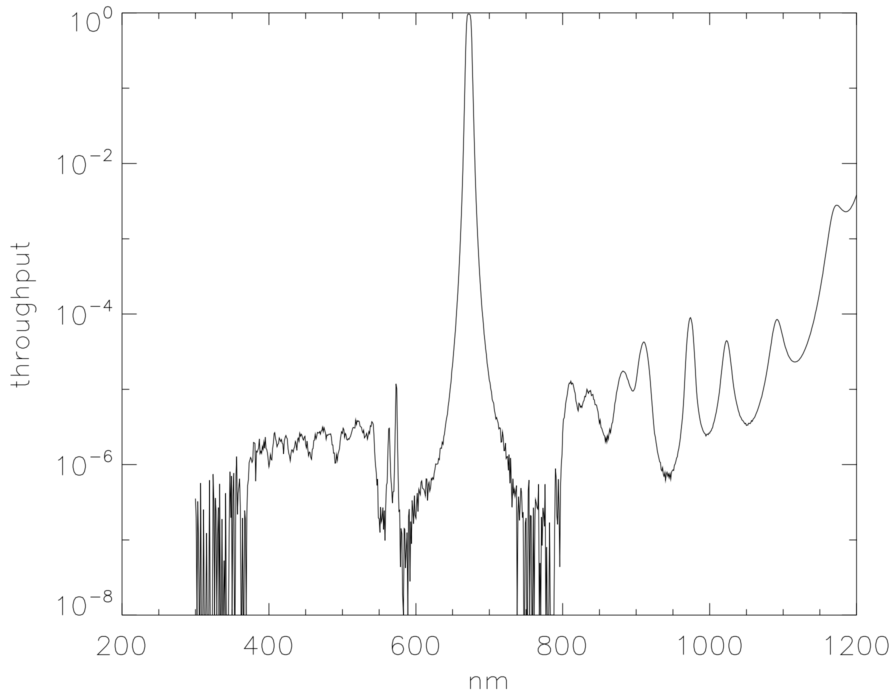

Figure 4. Profile of the new filter added to MMTCam.

The SWIRC instrument was not scheduled this quarter.

Work was completed on the MAESTRO mounting structure to correct a -800 micron focus offset between the instrument and the nominal telescope focus. The final result of this correction is that MAESTRO is now +200 microns out of focus from the nominal center of focus of the telescope. The off-axis guiding software for MAESTRO was updated based on the current location of the MAESTRO slits to allow for off-axis guiding (though the significant focus offset between the system and the instrument makes off-axis impossible without further procedural changes). Possible solutions have been identified for this focus discrepancy and will be tested during future M&E time.

f/15 Instrumentation

There were no adaptive optics (AO) observing runs during this quarter.

Considerable testing and debugging was performed on the wavefront sensor (WFS) camera hardware. Both the WFS camera pre-amp board and cabling were replaced with the laser guide star (LGS) AO systems' hardware to determine if that addressed some of the natural guide star (NGS) AO WFS camera issues such as camera freezes and syncing problems.

Work continues on the new AO system power supply.

Topboxes and Wavefront Sensors (WFS)

f/5 WFS

Work continues on the development of a new WFS package for both f/5 and f/9. The goal is to create a homogeneous baseline of software that can be more easily updated to add features in the future, specifically off-axis wavefront sensing for MAESTRO and Binospec. This has become a larger undertaking than originally planned, but progress remains constant, and we are optimistic that the new system will be ready when Binospec enters commissioning, tentatively planned for 2015.

Facilities

Main Enclosure

During summer shutdown, cement cracks in the loading dock area were sealed and the following areas received a fresh coat of paint: east stairwell, loading dock, drive room, elevator hallway, yoke arms, and outside entry way decks. Touch-ups were done to the 26V rack and main hallway area.

Control Room

The observatory control room was refurbished during summer shutdown. The cabling in the ceiling was cleaned up, old wiring was removed, and all cables routed through the ceiling were put in cable trays. Old consoles and other furniture were removed, and new power cables were run where necessary for the new consoles. A mount was fabricated for the still-needed analog TV monitor, and new light fixtures were installed.

Two telstat monitors are now emplaced on the wall on new mounts, and the SAO computer monitors have been mounted in a more efficient quad mount. All unnecessary equipment was removed.

The openings in the walls between the kitchen and control room were sealed with plastic barrier material to keep animals from the control room ceiling. New ceiling tiles that match the control room were also installed in the kitchen area.

New wallpaper was hung, the floor was cleaned and waxed, and seven adjustable LED lights were purchased and installed for the operators' console.

Figure 5. Assembly on August 8 of new control room furniture by employees of Goodmans, the vendor from whom it was purchased. Looking on are MMTO personnel from left: C. Knop, G. Williams, and T. Gerl.

Building Cabling and Cable Drapes

The west telescope cable drape was reworked during shutdown. All of the mule tape holding up the cable bundle was removed and replaced with new lanyards constructed from vinyl-coated wire rope. A small section of vinyl-coated fencing worked well for offloading the weight of the cable drape from the tray elbow that feeds into the cable chain on the telescope. We discovered that the cables had been rubbing on the elbow hardware and wearing through the cable jackets, and this revised setup corrected that problem. The arm holding the lanyards was also painted to match the telescope yoke. The cables are now easily accessible by just removing the lanyards rather than untying a lot of mule tape.

The east cable drape was also serviced. Loose cables were tied down and old ones were removed. Future work to be done will include adding power conduit, removing extension cords that were temporary installations, and preparing for the eventual addition of a cable chain similar to the one on the west side, if possible.

The J-hook cable system, across the north side of the chamber, was replaced by wire basket trays as used elsewhere in the building. All cables were put in the new tray.

Common Building

A thorough wiping down of the AO clean room in the Common Building was completed during shutdown.

General Infrastructure

TBR, the prime contractor for the roof project, worked with architect Dave Schaumbach to define a snow-melt system for the new roof. A mock-up of a small section of the heated roof is being assembled and will be tested to verify its ability to melt snow.

Installation by Firetrol of the Honeywell basic fire alarm system is complete, and the system is active. However, Keltron delivered a second replacement for the dedicated MMT fire alarm computer that provides connectivity for remote monitoring, and this unit also exhibited some problems during boot. Inspection and final acceptance of the system has been delayed to late October.

Sub-contractors have been selected for HVAC work, and purchase submittals for new equipment are being reviewed. Work is expected to start in the fall. The work will include installing HVAC in the control room, replacing aging chillers throughout the MMT building, new glycol pumps, a new blower motor with a variable frequency drive, and commissioning of the spare chiller on site (the "Carrier on the rock"). This will become the primary chiller for the facility. Switching over to the Carrier on the rock will move this waste heat about 25 meters further from the telescope and should result in a slight improvement in the seeing at the site.

Compressed Air System

After various vendor delays, the hygrometer ordered in June was finally received. Once resources are available, the hygrometer will be temporarily mounted in the compressed air plumbing to gather data on the current system performance.

Computers and Information Technology

Application Development

Work continued on the “param-server” Node.js server during this quarter. A new HTTP-based, REST (“Representational state transfer”) application programming interface (API) was implemented for the server. All commands within the existing WebSocket API for this server are now also available through the RESTful API. This allows user interfaces to be created using either WebSocket requests or standard AJAX (“Asynchronous JavaScript and XML”) GET and POST requests to obtain data from the Node.js server.

Param-server now also serves static HTML, Javascript, and CSS files to web browser clients. This allows the server to act as a standard web server, similar to an Apache web server. The Node.js server allows continuous client-server connections through WebSockets and event-driven programming. Apache servers assume discontinuous client-server connections.

New code was added to param-server to perform multiple MySQL queries in a single WebSocket or RESTful request. This functionality is used extensively in producing time-series plots of multiple data sets of miniserver background log data. Typically up to eight different MySQL data sets are queried in one request. These data are then plotted against the same time axis.

The param-server Node.js servers that currently run on the *ops* and *nas3* computers communicate through a second network interface on these computers: "*ops-2*" and "*nas3-2*". IP addresses for these network interfaces have been opened through the University firewall so that the servers are available to the general public. Implementation of new web pages through the Node.js servers has started with WebSocket-based parameter and miniserver pages. These pages are linked from the webpage http://staff.mmto.org.

Work is also underway to update the background log plotting web interface. This interface is the primary method by which staff interacts with the MySQL background logs. The updates to the plotting interface may include: 1) upgrading to the current version of the Flot Javascript charting library, 2) using the jQuery-UI Javascript library for more standardized widgets, 3) requesting data directly through the new param-server Node.js server, 4) using web browser cookies to remember the user's most recent settings, and 5) removing some seldom-used options of the web interface.

Desktop-based and web-based versions of a "telstat widget launcher" graphical user interface (GUI) were created for all of the 30-35 widgets of the telstat display. This GUI allows users to view individual telstat widgets, whether at the MMTO or elsewhere. A new desktop shortcut was added to *pixel* that allows astronomers quick access to a wide array of weather and telstat widgets through this GUI.

Error handling was improved in the M1 cell GUIs so that they don't freeze when encountering a rare network error.

An annunciator check was implemented for the NTP (Network Time Protocol) clock.

Network

Issues related to degraded summit-campus microwave connections were addressed. After coordination with Smithsonian Institution (SI) staff, one of the microwave radios was found to be defective. This radio was powered off and reliable microwave connections were re-established, but with reduced transmission redundancy. SI staff are ordering a replacement radio in order to restore the previous level of redundancy in this microwave link.

The following major system administration issues were addressed:

- Startup problems with the DHCP (Dynamic Host Configuration Protocol) daemon and the DNS (Domain Name System) daemons
- Bad disk sectors on *chisel* and *pipewrench* computers, which may require replacement of the hard drives

- Instabilities of the campus NAT (network address translation) gateway hardware device
- Networking problems on *pipewrench* due to the disappearance of its USB-to-ethernet adapter
- Inconsistencies in the Fedora RPM (RPM Package Manager) packages on the *f9wfs* computer resulting from an unclean power off, and
- Security issues regarding our SSL certificate.

Routine system administration has been completed on all MMTO OS X machines, including OS X, Xcode, and MacPorts updates. Preparation has begun for the update to OS X 10.10 (Yosemite) to ensure minimal issues in the upgrade process. New releases of CentOS 7 packages were installed on the "*ops*" computer. DSM 5 and MariaDB were updated on *nas1*, *nas2*, and *nas3*. The MariaDB update broke the MySQL master-slave replication and required the MariaDB/MySQL configuration files to be recreated on *nas1* and *nas3*. A few hours of data were lost during this re-configuration. In addition, patches were applied to address the malicious "Bash Shellshock" software bug on Linux and Mac computers.

IRAF was updated to version 2.16.1 on the *hacksaw* server (which is cross mounted to all other MMT machines that use it, including *pixel,* the observer's computer). This led to a number of problems when using *pixel* to observe. Namely, the instrument setting in ccdred.instrument had to be manually set to "dev$null" and RVSAO had several issues reading the file headers to create wavelength vectors. To ensure that future observers do not have issues with these settings, we have added ccdred.instrument="dev$null" to the login.cl files and recompiled RVSAO to recreate the pre-upgrade functionality of the software.

Hardware/Software Interfaces

The USB-ethernet dongle for *pipewrench* was replaced and upgraded from USB 2.0 to USB 3.0. This dongle is being used because of the failure of the onboard network interface on the motherboard. Issues continue with this network connection. Replacement of the motherboard on *pipewrench*, which includes the onboard network interface, is being considered.

Over summer shutdown, *hacksaw's* virtual disk image was permanently compacted, making future backups of the server quicker.

Telemetry, Logging, and Database Management

The "scheduler" database files were created, based upon input from the 2012 SPIE paper by D. Porter and others. Development of the scheduler database and associated user interfaces is ongoing.

Additional parameters were added to the existing Redis server on *hacksaw* and its slaves: *ops*, *nas1*, and *nas3*. These new parameters include details of annunciator status and derived parameters from dataserver2. These parameters are all available through the Node.js param-server.

All of the Sunnyside aluminization data through September 19, 2014 have been transferred from the "aluminization" computer to the main MMTO *nas1-ops-nas3* MySQL master-slave database system.

This allows 24/7 access to the data by staff, and acts as a redundant copy of the data in case of hardware failure of the aluminization computer.

Weather and Environmental Monitoring

A request from K. Rubin and N. Caldwell at CfA prompted an investigation of the percentage of telescope time lost to poor weather on a monthly basis. The figure below shows a five-year average (2009-2013) of the time lost to weather. It was found that April, May, and June are the best months for observing.

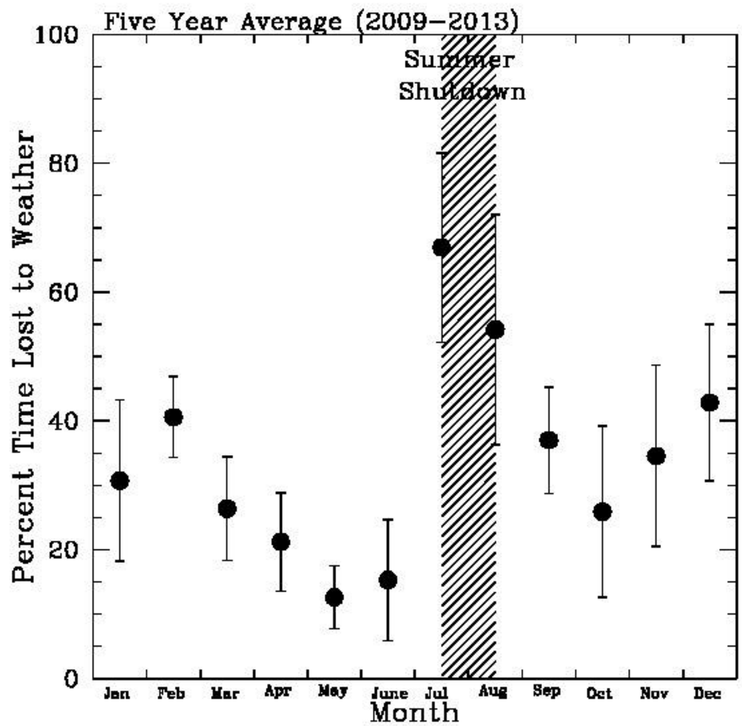

Figure 6. Average of time lost to weather between 2009-2013.

All Sky Camera and Web Cameras

After problems were experienced with the Skycam, it was discovered that it had burnt-out pixels, defects in the Plexiglas lens, and a failed de-icing heater in its enclosure. Both the camera and enclosure were replaced. The new camera is a Peltier-cooled model, and the new enclosure has external power supplied for the heater section. That, along with a new lens, has resulted in a very clear sky image.

Seeing

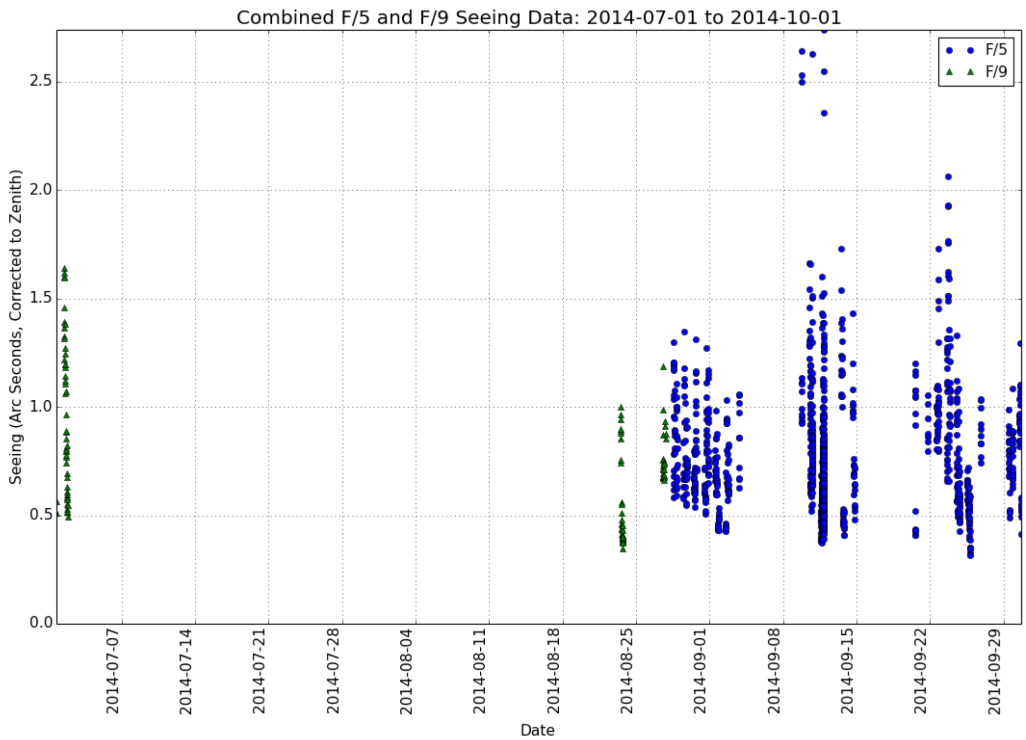

Figure 7. The seeing data from both the f/5 (blue) and f/9 (green) WFS datasets are shown as a function of time during the July-September quarter. Seeing measurements between the two configurations are historically identical. The long gap in data during July and August resulted from monsoon weather, followed by summer shutdown.

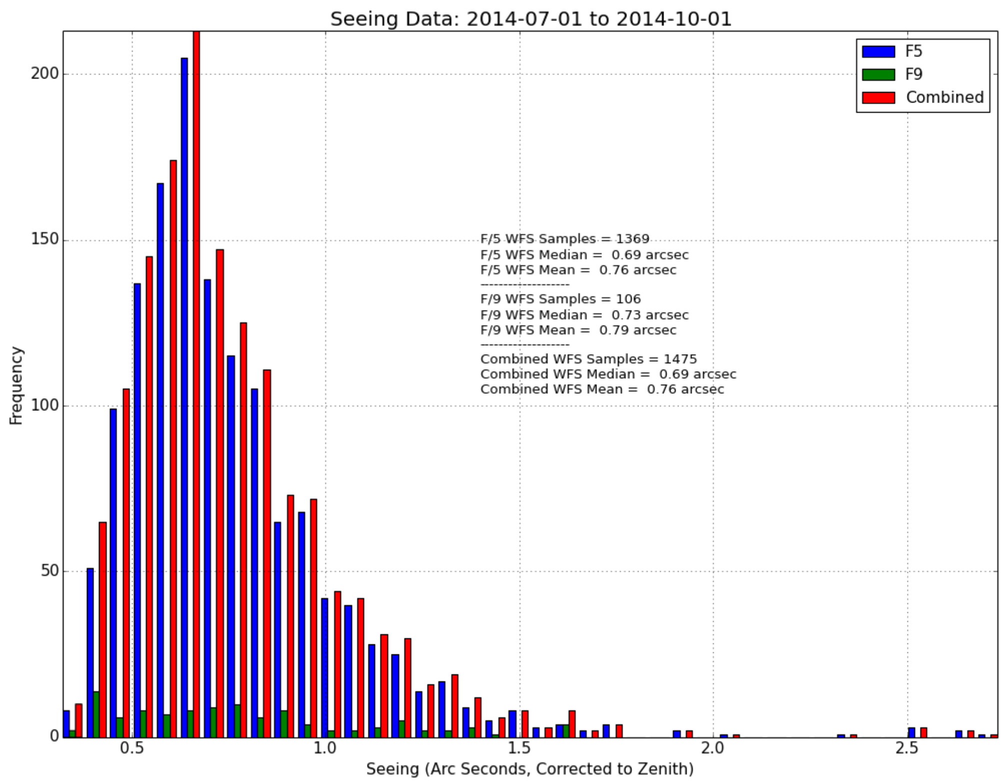

Figure 8. The histograms of seeing values for the July-September quarter is shown for f/5 (blue), f/9 (green), and the full data set (red). The f/5 median seeing (0.69") is comparable to the f/9 median seeing (0.73"), although the f/5 data set is much larger for this quarter (1369 data points for f/5 compared to 106 for f/9). Taking the full data set, the median seeing for this quarter was 0.69" compared to an historical median of ~0.8", illustrating the excellent seeing during this quarter.

User Support

Remote Observing

The MMTO supported a total of 16.5 nights of remote observing this quarter. Eight nights were for UA/ASU observers, eight nights for CfA, and 0.5 night of Director's time allocated to J. Farihi (IoA, Cambridge).

Friction, the computer made available in the Steward Observatory remote observing room, suffered a catastrophic power supply failure. As demand for this machine was quite light, we have opted not to formally replace it. The single observer who used the remote observing room now connects using his own machine. The Mac Mini *pluto*, in the MMTO conference room, has been set up as an emergency remote observing machine should the need arise in the future for an observatory-supported connection to the mountain from campus.

Data Archive

Monitoring continues of the data archive for Blue Channel, Red Channel, and MAESTRO data on *pixel*. Data are backed up daily to two NAS boxes. Two users have requested a backup due to external drive failures.

Reduction Procedures

In collaboration with the SAO Telescope Data Center, the existing public Hectospec reduction package, HSRED, was updated to improve existing algorithms, add new functionality, and was released as HSRED version 2.0 (http://www.mmto.org/node/536). Improvements include implementation of wavelength calibration support for the 600 gpm grating, improved wavelength calibration robustness, a new model for smooth variations in the sky background as a function of fiber number across the chip (leading to improved sky subtraction residuals), faster cosmic ray rejection, an algorithm to remove the "red monster" light leak longward of 8500 angstroms, corrections for the A- and B-band telluric absorption features, and a more robust co-addition method for no-flux calibrated images. The code is fully available and has been used by numerous observers already.

Documentation

Most of the old MMT drawings that had been temporarily moved to the campus shop were inventoried and placed into a database noting the drawings' number, total sheets, and the type or system for that drawing. This work was done by K. Comisso in May-December 2013. The drawings were rolled up and placed into cardboard document boxes for final disposition.

The drawings were reorganized and placed into flat-file storage by D. Gerber at basecamp, categorized by the system the drawing represented:

1. Building: structural and architectural drawings of the MMT building.
2. Azimuth: mechanical drawings of the azimuth assembly of the MMT.
3. Elevation: mechanical drawings of the MMT elevation assembly.
4. Encoder: drawings associated with the encoders.
5. Rotator: mechanical drawings of the MMT instrument rotator assembly.
6. Servo: drawings for the MMT servos.
7. f/5, f/9, f/15: separate categories for each secondary mirror and associated drawings.
8. Facility: drawings for the facility and summit area.
9. Primary mirror: M1 drawings and the primary mirror cell.
10. Aluminization: mechanical drawings and other information on aluminization equipment.
11. Optics Support Structure (OSS): All drawings referring to the OSS.
12. Shop: Drawings for the Summit Support Building.
13. Road: Drawing for the MMT access road.
14. Historic: catch-all for drawings deemed obsolete or removed.

15. Other Mirrors: electrical drawings from other Observatories (Kitt Peak, Veritas, Magellan, IOTA).
16. WFS: drawings dedicated to the f/5 wavefront sensor.
17. Hexapod: drawings for the f/5 hexapod.

Many of the drawings are quite old and may contain formaldehyde, so care should be taken when handling them. Wear gloves to prevent damage to the fragile paper and wear a dust mask to prevent inhaling dust-impregnated paper particles.

Public Relations and Outreach

MMTO in the Media

The MMT was featured in a September 1 Green Valley News article, written by Kitty Bottemiller, entitled "When storms come: Observatory works with nature to help scientists." Two lightning and telescope photographs taken by S. Gottilla were shown with the article.

Using the MMT, J. Bochanski's discovery of the Milky Way's most distant stars was featured in a Sky & Telescope blog on July 9, and then picked up by other media outlets including Scientific American, Space.com, Discovery, and National Geographic.

Appendix I - Publications

MMT Related Scientific Publications

(An online publication list can be found in the MMTO ADS library at http://www.mmto.org/node/244 *)*

14-39 The Close Binary Frequency of Wolf-Rayet Stars as a Function of Metallicity in M31 and M33
K.F. Neugent and P. Massey
ApJ, **789**, 10

14-40 Constraining Sub-parsec Binary Supermassive Black Holes in Quasars with Multi-epoch Spectroscopy. II. The Population with Kinematically Offset Broad Balmer Emission Lines
X. Liu, et al.
ApJ, **789**, 140

14-41 The Most Distant Stars in the Milky Way
J.J. Bochanski, et al.
ApJ, **790**, 5

14-42 Luminous and Variable Stars in M31 and M33. II. Luminous Blue Variables, Candidate LBVs, Fe II Emission Line Stars, and Other Supergiants
R.M. Humphreys, et al.
ApJ, **790**, 48

14-43 A UV to Mid-IR Study of AGN Selection
S.M. Chung, et al.
ApJ, **790**, 54

14-44 New 2MASS Near-infrared Photometry for Globular Clusters in M31
S. Wang, et al.
AJ, **148**, 4

14-45 Discovery of Eight z ~ 6 Quasars from Pan-STARRS1
E. Banados, et al.
AJ, **148**, 14

14-46 The Radial Metallicity Gradient and the History of Elemental Enrichment in M81 Through Emission-line Probes
L. Stanghellini, et al.
A&A, **567**, 88

14-47 Massive Compact Galaxies with High-Velocity Outflows: Morphological Analysis and Constraints on AGN Activity
P.H. Sell, et al.
MNRAS, **441**, 3417

14-48 Near-Infrared Counterparts of Ultraluminous X-ray Sources
M. Heida, et al.
MNRAS, **442**, 1054

14-49 Multi-epoch Spectropolarimetry of SN 2009ip: Direct Evidence for Aspherical Circumstellar Material
J. Mauerhan, et al.
MNRAS, **442**, 1166

14-50 A Surprising Consistency between the Far-Infrared Galaxy Luminosity Functions of the Field and Coma
S. Hickinbottom, et al.
MNRAS, **442**, 1286

14-51 Dynamical Models of Elliptical Galaxies – II. M87 and its Globular Clusters
A. Agnello, et al.
MNRAS, **442**, 3299

14-52 Electron-Ion Equilibrium and Shock Precursors in the Northeast Limb of the Cygnus Loop
A.A. Medina, et al.
ApJ, **791**, 30

14-53 The Black Hole Mass of NGC 4151. II. Stellar Dynamical Measurement from Near-infrared Integral Field Spectroscopy
C.A. Onken, et al.
ApJ, **791**, 37

14-54 Influence of Stellar Multiplicity on Planet Formation. II. Planets are Less Common in Multiple-star Systems with Separations Smaller than 1500 AU
J. Wang, et al.
ApJ, **791**, 111

14-55 Mid-Infrared-Selected Quasars. I. Virial Black Hole Mass and Eddington Ratios
Y.S. Dai, et al.
ApJ, **791**, 113

14-56 The Universal Relation of Galactic Chemical Evolution: The Origin of the Mass-Metallicity Relation
H.J. Zahid, et al.
ApJ, **791**, 130

14-57 SHELS: A Complete Galaxy Redshift Survey with R <=20.6
M.J. Geller, et al.
ApJ Supp, **213**, 35

14-58 Radius Constraints from High-speed Photometry of 20 Low-mass White Dwarf Binaries
J.J. Hermes, et al.
ApJ, **792**, 39

14-59 Variable Accretion Processes in the Young Binary-star System UY Aur
J. Stone, et al.
ApJ, **792**, 56

14-60 The Next Generation Virgo Cluster Survey. V. Modeling the Dynamics of M87 with the Made-to-measure Method
L. Zhu, et al.
ApJ, **792**, 59

14-61 Optical Properties of (162173) 1999 JU3: In Preparation for the JAXA Hayabusa 2 Sample Return Mission
M. Ishiguro, et al.
ApJ, **792**, 74

14-62 The Assembly Histories of Quiescent Galaxies since z=0.7 from Absorption Line Spectroscopy
J. Choi, et al.
ApJ, **792**, 95

14-63 The GALEX Ultraviolet Virgo Cluster Survey (GUViCS). III. The Ultraviolet Source Catalogs
E.N. Voyer, et al.
A&A, **569**, 124

14-64 Compton Thick Active Galactic Nuclei in Chandra Surveys
M. Brightman, et al.
MNRAS, **443**, 1999

14-65 Investigation of a Transiting Planet Candidate in Trumpler 37: An Astrophysical False Positive Eclipsing Spectroscopic Binary Star
R. Errmann, et al.
AN, **335**, 345

MMT Technical Memoranda / Reports

None

Non MMT-Related Staff Publications

Untangling the Nature of Spatial Variations of Cold Dust Properties in Star Forming Galaxies
Kirkpatrick, A., Calzetti, D. Kennicutt, R., Galametz, M., Gordon, K., Groves, B., Hunt, L., Dale, D., Hinz, J., & Tabatabaei, F.
ApJ, **789**, 130

A Far-IR View of the Starburst-drive Superwind in NGC 2146
Kreckel, K., Armus, L., Groves, B., et al., (J. Hinz)
ApJ, **790**, 26

Morphology and Environment of Galaxies with Disc Breaks in the S4G and NIRS0S
Laine, J., Laurikainen, E., Salo, H., et al., (J. Hinz)
MNRAS, **441**, 1992

Appendix II - Service Request (SR) and Response Summary: July – September, 2014

The MMT Service Request (SR) system is an online tool to track ongoing issues that arise primarily during telescope operations, although it can be used throughout the day and night by the entire staff. Once an SR has been created, one or more responses are created by staff members to address and eventually close the SR. These SRs and associated responses are logged into a relational database for later reference.

Figure 9 presents the distribution of SR responses by priority during the period of July through September. As seen in the figure, the highest percentage (71%) of responses were of the "Important" priority while 29% were of "Near-Critical" priority. There were no "Critical" or "Information Only" responses. "Critical" SRs address issues that are preventing telescope operation, while "Near-Critical" SRs relate to concerns that pose an imminent threat to continued telescope operation. There were a total of 42 SRs during this three-month period.

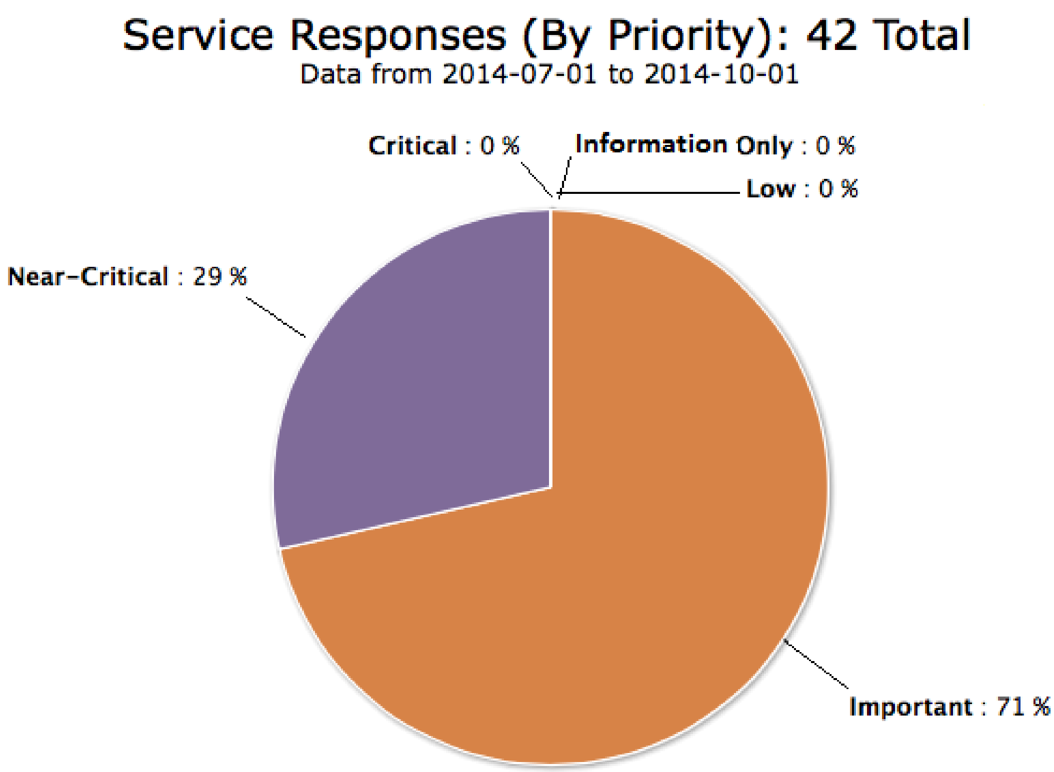

Figure 9. Service Request responses by priority during July through September 2014. The majority (71%) of the responses are related to SRs of "Important" priority, while 29% were "Near-Critical." There were no "Critical," "Low," or "Information Only" responses.

Figure 10 presents the same 42 SR responses grouped by category. These categories are further divided into subcategories for more detailed tracking of issues. The majority of the responses from July through September were related to the "Control Room," "Software," "Thermal Systems," and "Weather Systems" categories.   Details of "Near Critical" SRs are included below.

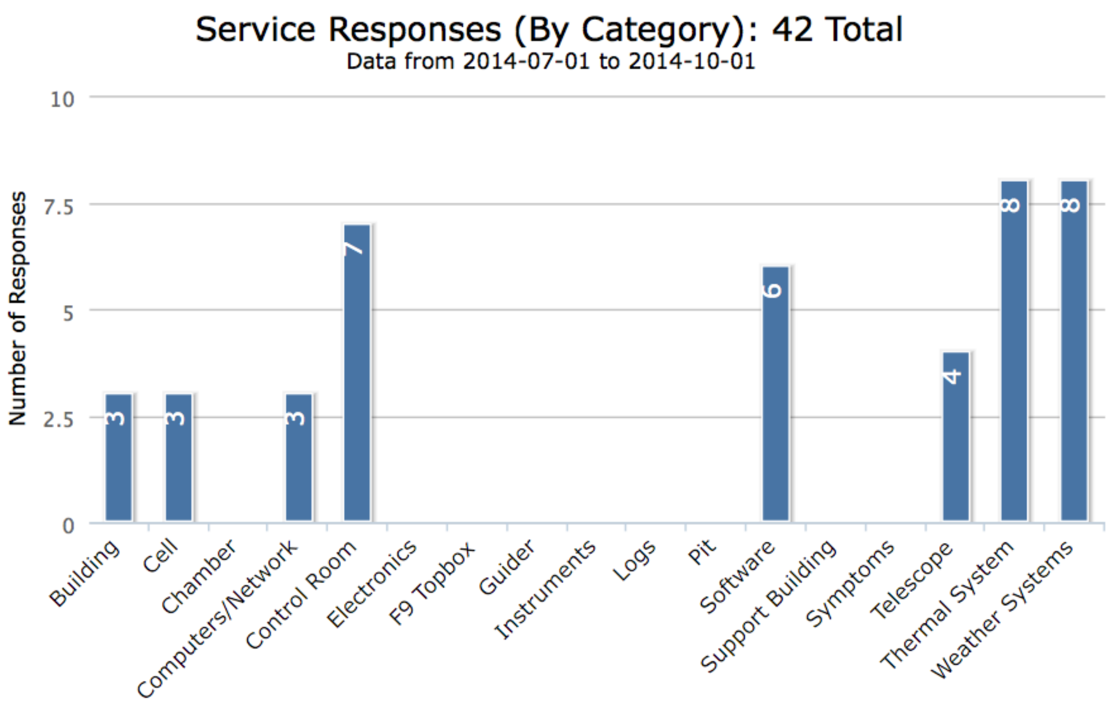

Figure 10. Service Request responses by category during July through September 2014. The majority of responses were within the "Control Room," "Software," "Thermal Systems," and "Weather Systems" categories.

There were no "Critical" SRs during this reporting period.

Appendix III - Observing Statistics

The MMTO maintains a database containing relevant information pertaining to the operation of the telescope, facility instruments, and the weather. Details are given in the June 1985 monthly summary. The data attached to the back of this report are taken from that database.

Use of MMT Scientific Observing Time

July 2014

Instrument	Nights Scheduled	Hours Scheduled	Lost to Weather	*Lost to Instrument	**Lost to Telescope	***Lost to Gen'l Facility	****Lost to Environment	Total Lost
MMT SG	11.00	86.30	86.30	0.00	0.00	0.00	0.00	86.30
PI Instr	3.00	23.30	7.80	0.00	0.00	0.00	0.00	7.80
Engr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sec Change	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	**14.00**	**109.60**	**94.10**	**0.00**	**0.00**	**0.00**	**0.00**	**94.10**

Time Summary Exclusive of Shutdown

Percentage of time scheduled for observing	100.0
Percentage of time scheduled for engineering	0.0
Percentage of time scheduled for sec/instr change	0.0
Percentage of time lost to weather	85.9
Percentage of time lost to instrument	0.0
Percentage of time lost to telescope	0.0
Percentage of time lost to general facility	0.0
Percentage of time lost to environment (non-weather)	0.0
Percentage of time lost	85.9

August 2014

Instrument	Nights Scheduled	Hours Scheduled	Lost to Weather	*Lost to Instrument	** Lost to Telescope	***Lost to Gen'l Facility	****Lost to Environment	Total Lost
MMT SG	10.00	89.60	75.90	0.00	0.00	0.50	0.00	76.40
PI Instr	3.00	28.00	0.00	0.00	0.00	0.00	0.00	0.00
Engr	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sec Change	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	**13.00**	**117.60**	**75.90**	**0.00**	**0.00**	**0.50**	**0.00**	**76.40**

Time Summary Exclusive of Shutdown

Percentage of time scheduled for observing	100.0
Percentage of time scheduled for engineering	0.0
Percentage of time scheduled for sec/instr change	0.0
Percentage of time lost to weather	64.5
Percentage of time lost to instrument	0.0
Percentage of time lost to telescope	0.0
Percentage of time lost to general facility	0.4
Percentage of time lost to environment (non-weather)	0.0
Percentage of time lost	65.0

*** Breakdown of hours lost to facility

0.50 Remote observer computer at Steward Obs. not working

Year to Date August 2014

Instrument	Nights Scheduled	Hours Scheduled	Lost to Weather	Lost to Instrument	Lost to Telescope	Lost to Gen'l Facility	Lost to Environment	Total Lost
MMT SG	89.00	868.20	399.00	1.50	1.16	13.00	0.00	414.66
PI Instr	108.00	1008.50	172.70	1.75	26.65	4.50	0.00	205.60
Engr	11.00	111.40	16.15	0.00	0.00	0.00	0.00	16.15
Sec Change	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	**208.00**	**1988.10**	**587.85**	**3.25**	**27.81**	**17.50**	**0.00**	**636.41**

Time Summary Exclusive of Shutdown

Percentage of time scheduled for observing	94.4
Percentage of time scheduled for engineering	5.6
Percentage of time scheduled for sec/instr change	0.0
Percentage of time lost to weather	29.6
Percentage of time lost to instrument	0.2
Percentage of time lost to telescope	1.4
Percentage of time lost to general facility	0.9
Percentage of time lost to environment (non-weather)	0.0
Percentage of time lost	32.0

September 2014

Instrument	Nights Scheduled	Hours Scheduled	Lost to Weather	*Lost to Instrument	**Lost to Telescope	***Lost to Gen'l Facility	****Lost to Environment	Total Lost
MMT SG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PI Instr	25.00	248.30	145.95	5.50	0.75	0.00	0.00	152.20
Engr	5.00	48.20	35.20	0.00	2.00	0.00	0.00	37.20
Sec Change	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	**30.00**	**296.50**	**181.15**	**5.50**	**2.75**	**0.00**	**0.00**	**189.40**

Time Summary

Percentage of time scheduled for observing	83.7
Percentage of time scheduled for engineering	16.3
Percentage of time scheduled for secondary change	0.0
Percentage of time lost to weather	61.1
Percentage of time lost to instrument	1.9
Percentage of time lost to telescope	0.9
Percentage of time lost to general facility	0.0
Percentage of time lost to environment	0.0
Percentage of time lost	63.9

* Breakdown of hours lost to instrument

1.00 Instrument setup issues
2.50 Hectospec homing issues
2.00 Hecto hardware computer

** Breakdown of hours lost to telescope

0.25 M1 panic
2.00 f/5 oscillations
0.50 Pointing issue

Year to Date September 2014

Instrument	Nights Scheduled	Hours Scheduled	Lost to Weather	Lost to Instrument	Lost to Telescope	Lost to Gen'l Facility	Lost to Environment	Total Lost
MMT SG	89.00	868.20	399.00	1.50	1.16	13.00	0.00	414.66
PI Instr	133.00	1256.80	318.65	7.25	27.40	4.50	0.00	357.80
Engr	16.00	159.60	51.35	0.00	2.00	0.00	0.00	53.35
Sec Change	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	**238.00**	**2284.60**	**769.00**	**8.75**	**30.56**	**17.50**	**0.00**	**825.81**

Time Summary Exclusive of Shutdown

Percentage of time scheduled for observing	93.0
Percentage of time scheduled for engineering	7.0
Percentage of time scheduled for secondary change	0.0
Percentage of time lost to weather	33.7
Percentage of time lost to instrument	0.4
Percentage of time lost to telescope	1.3
Percentage of time lost to general facility	0.8
Percentage of time lost to environment	0.0
Percentage of time lost	36.1